

# Optical Fabrication and Metrology of Aspheric and Freeform Mirrors, Phase I

Completed Technology Project (2012 - 2012)



## Project Introduction

The requirement for cost effective manufacturing and metrology of large optical surfaces is instrumental for the success of future NASA programs such as LISA, WFIRST and IXO. OptiPro's UltraForm Finishing (UFF) is a sub-aperture compliant wheel and belt type polishing process for rapid material removal from the ground state to a finished optic. The UFF removes residual grinding sub-surface damage, mid spatial frequency errors, and provides the mechanism required for surface corrections. OptiPro's technologically advanced optical manufacturing capabilities along with a support partnership with the University of Rochester Mechanical Engineering Department and the Penn State EOC, gives us a very strong team and a clear path towards solving the difficult problems associated with, grinding, polishing and metrology of large complex optical surfaces. The UFF, with its 5 axis of motion provides a platform to polish traditional flats and spheres as well as aspheres and freeform shapes. The UFF was designed for deep concave shapes and it is suitable for finishing conformal optics. The proposed Phase I will include testing the feasibility of implementing large UFF tools for grinding and polishing of a scaled down fused quartz cylinder (200 x 200 mm) which represents the large forming mandrel material and geometry. Grinding as well as polishing forces will be optimized by using finite element analysis (FEA) techniques. The part geometry will be measured by a non contact optical probe using OptiPro's UltraSurf free-form measurement system. We envision that the work done during Phase I will be extended during Phase II to a large tapered cylinder forming mandrel or an aspheric mirror surface with integration of the UltraSurf capabilities to the UFF platform. Currently the UFF and UltraSurf platforms address the fabrication requirements for small aspheric and freeform optics, this proposal implements new tools on these platforms required for the fabrication of large mirrors.



Optical Fabrication and  
Metrology of Aspheric and  
Freeform Mirrors, Phase I

## Table of Contents

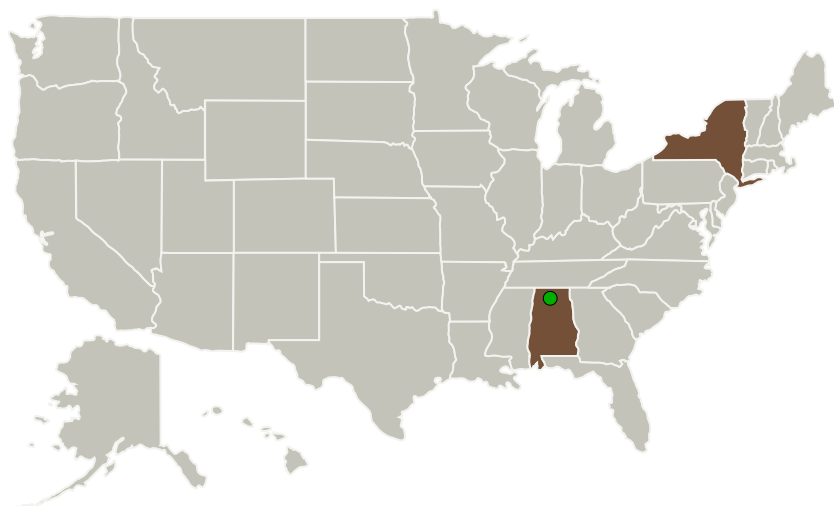
Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

Optical Fabrication and Metrology of Aspheric and Freeform Mirrors,  
Phase I

Completed Technology Project (2012 - 2012)



## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
OptiPro Systems LLC	Lead Organization	Industry	Ontario, New York
● Marshall Space Flight Center (MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

## Primary U.S. Work Locations

Alabama	New York
---------	----------

## Project Transitions

▶ **February 2012:** Project Start

✓ **August 2012:** Closed out

## Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140330>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

OptiPro Systems LLC

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

David Mohring

**Co-Investigator:**

David Mohring

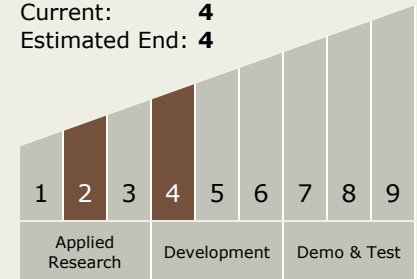
# Optical Fabrication and Metrology of Aspheric and Freeform Mirrors, Phase I

Completed Technology Project (2012 - 2012)



## Technology Maturity (TRL)

Start: 2  
Current: 4  
Estimated End: 4



## Technology Areas

### Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - └ TX12.4 Manufacturing
    - └ TX12.4.3 Electronics and Optics Manufacturing Process

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System